embodiments, the subject is a human. In certain embodiments the subject has or has been diagnosed with or is at risk of developing emphysema. In certain embodiments the subject has or has been diagnosed with or is at risk of developing COPD. In certain embodiments the method further comprises selecting a subject in need of reversal of emphysematous lung destruction prior to administering to the subject a composition comprising a GHK peptide. In certain embodiments, administering a composition comprising GHK to the subject reverses emphysematous lung destruction by at least 10%, e.g., by at least 20%, at least 30%, at least 50%, at least 75%, at least 100%, at least 200% or more as compared to lung tissue repair or healing prior to administration of the composition or as compared to lung tissue repair or healing in patients not receiving treatment with the composition. In certain embodiments, contacting the lung tissue of the patient with a composition comprising GHK increases the lung tissue repair or healing by at least 10%, e.g., by at least 20%, at least 30%, at least 50%, at least 75%, at least 100%, at least 200% or more as compared to lung tissue repair or healing prior to administration of the composition or as compared to lung tissue repair or healing in patients not receiving treatment with the composition.

[0015] In certain embodiments, there is provided herein a method of enhancing the repair of extracellular matrix in the lung tissue by contacting the lung tissue of a subject with a GHK peptide. In certain embodiments the subject is a mammal. In further embodiments, the subject is a human. In certain embodiments the subject has, has been diagnosed with, or is at risk of developing emphysema. In certain embodiments the subject has, has been diagnosed with, or is at risk of developing COPD. In certain embodiments the method further comprises selecting a subject in need of enhanced repair of extracellular matrix in the lung tissue prior to contacting the lung tissue of the subject with the composition. In certain embodiments, contacting the lung tissue of the patient with a composition comprising GHK increases the repair of the extracellular matrix by at least 10%, e.g., by at least 20%, at least 30%, at least 50%, at least 75%, at least 100%, at least 200% or more as compared to repair of the extracellular matrix prior to administration of the composition or as compared to repair of the extracellular matrix in patients not receiving treatment with the composition.

[0016] In certain embodiments, there is provided herein a method of increasing TGF-β signaling in the lung tissue by contacting the lung tissue of a subject with a GHK peptide. In certain embodiments the subject is a mammal. In further embodiments, the subject is a human. In certain embodiments the subject has, has been diagnosed with, or is at risk of developing emphysema. In certain embodiments the subject has, has been diagnosed with, or is at risk of developing COPD. In certain embodiments the method further comprises selecting a subject in need of increased TGF-β signaling in the lung tissue prior to contacting the lung tissue of the subject with the composition. In certain embodiments, contacting the lung tissue of the patient with a composition comprising GHK increases TGF-β signaling by at least 10%, e.g., by at least 20%, at least 30%, at least 50%, at least 75%, at least 100%, at least 200% or more as compared to TGF-β signaling prior to administration of the composition or as compared to TGF-(signaling in patients not receiving treatment with the composition.

[0017] In certain embodiments, there is provided herein an assay for assessing the lungs of a subject comprising; 1) transforming the expression product of at least two marker genes in a lung tissue sample obtained from a subject into detectable targets wherein the marker genes are selected from Table 1 and/or Table 2, 2) measuring the level of the detectable targets 3) comparing the level of the detectable targets in the lung tissue sample from a subject to reference levels of those detectable targets, wherein a statistically significant difference in expression levels of at least two detectable targets in the sample from the subject relative to the reference levels indicates the presence of emphysema. In certain embodiments, one or more of the marker genes of emphysematous damage are selected from the group consisting of ITGB1, NEDD9, ACVRL1, SMAD6 and TGFBR2.

[0018] In certain embodiments, the two or more marker genes of emphysematous damage are selected from Table 1 and/or Table 2. In certain embodiments, one or more of the marker genes of emphysematous damage are selected from the group consisting of ITGB1, NEDD9, ACVRL1, SMAD6 and TGFBR2. In certain embodiments, one or more of these marker genes can be used in the assays and systems described herein. In certain embodiments, one or more of these marker genes and one or more additional genes can be used in the assays and systems described herein.

[0019] In certain embodiments, the expression product of a marker gene is a mRNA. In certain embodiments, the expression product of a marker gene is a protein.

[0020] In certain embodiments, the assay described above identifies patients having severe emphysema. In certain embodiments, the assay described above identifies a patient in need of a treatment for emphysema. In certain embodiments, a subject indicated to have emphysema according to the assay described above is administered a GHK tripeptide.

[0021] In certain embodiments, there is provided herein a computer implemented system for detecting emphysema in a subject, the system comprising; a determination module configured to identify and detect the level of expression of at least two marker genes in a lung tissue sample obtained from a subject wherein the marker genes are selected from Table 1 and/or Table 2, a storage module configured to store output data from the determination module, a comparison module adapted to identify from the output data whether the level of expression of at least two maker genes in the lung tissue sample obtained from a subject varies by a statistically significant amount from the expression level found in a reference sample and a display module for displaying whether two or more marker genes have a statistically significant variation in expression level in the lung tissue sample obtained from a subject as compared to the reference expression level and/or displaying the relative expression levels of the marker genes. In certain embodiments, if the computing module determines that the level of expression of at least two marker genes in the lung tissue sample obtained from a subject varies by a statistically significant amount as compared to the level of expression the in the reference sample, the display module displays a signal indicating the increased expression level in the sample obtained from a subject. In further embodiments, the signal indicates that the subject has an increased likelihood of having emphysema. In certain embodiments, one or more of the marker genes of emphysematous damage are selected from the group consisting of ITGB1, NEDD9, ACVRL1, SMAD6 and TGFBR2.

[0022] In certain embodiments, the computer-implemented system displays a signal indicating that the expression levels in the sample obtained from a subject vary from those of the